

**To What Extent Does Early Childhood Education Impact Later Involvement with the
Juvenile Justice System?**

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Abstract

I am investigating the impact of early childhood education on future juvenile crime. To do this, I created a detailed literature review using a variety of sources. I found the programs which had the biggest impact on the reduction of crime implemented early childhood education which targeted low-income areas. Some literature showed that early childhood education programs had no impact on later behavioral and educational outcomes. However, these programs typically did not target low-income areas and often offered a lower quality of care than the next best alternative. Programs that targeted low-income areas like the Perry Preschool Project and more recent studies on Head Start and Smart Start showed successful results in the reduction of crime. More specifically, one study found that Head Start and Smart Start were most impactful in low-income areas. After reviewing the literature, I used data from the U.S. Census data center 'Kids Count' to compare rates of enrollment in preschool to juvenile crime convictions. I used data on enrollment in preschool for 3–4-year-old students from families under the 200% poverty level by state in 2005-2009. I also used data on youth involvement with the juvenile justice system from 2015-2019 by state. I then controlled for several relevant variables to help address omitted variable bias. With this data, I ran a regression analysis and found that preschool attendance does relate to later juvenile delinquency. A 10-percentage point increase in preschool attendance among 3–4-year-old students under the 200% poverty line in a state is associated with 23% to 26% lower juvenile crime 6-14 years later. This compares closely to the study by Anders, et al. 2023 which shows that high-quality preschool programs in high-poverty areas result in a 23% to 28% reduction in future crime.

Introduction

This research is aiming to understand how early childhood education influences the future likelihood of incarceration. I will analyze the economic impacts that this early investment in children has on society. I will also discuss how the quality of early childhood care programs can impact results. Quality is defined as being in comparison to the next best available alternative. Due to the longevity of the nature of this question, I will pull from a variety of different sources. I will look at sources on how quality early childhood education impacts later academic achievements and behavior. There is much research on early childhood education and further youth development. However, the research on the long-term impacts of early childhood education on incarceration rates is thinner. Although other children may catch up with the academic learning portions of preschool, the socioemotional learning during this critical time could be substantial towards preventing crime. Demonstrating evidence on how early childhood education can result in economic savings could lead to more funding for these programs and the shaping of productive citizens. I aim to address a gap in the research in this field by analyzing a variety of sources and combining them along with analyzing state data to further understand the impact of quality early childhood education on future juvenile delinquency.

While some of the literature found pre-K programs to be ineffective or counter-effective, many found quality programs to have strong positive impacts, particularly on disadvantaged students. Potential reasons for some programs being effective could be the sustained environment hypothesis. Less affluent families may struggle to maintain skills learned if they do not receive sustained support. Therefore, going from a quality pre-K to a low-quality elementary program could impact the results of the pre-K program. Another could be the target populations. In the successful studies, the populations targeted were low-income where the pre-K program

would often be of higher quality in comparison to their next best alternative of care.

Furthermore, the period at which results were measured may be impacting the results. As such, some studies found a fadeout in middle school, but the results were again present in high school evaluation surveys.

Sources were identified using the University of Tennessee library database and recommendations from my advisor, Dr. Celeste Carruthers, in the Economics department at the University of Tennessee, Knoxville. Specifically, I searched through the databases for studies related to early childhood education and future outcomes for participants. I looked at studies that used experiments or analyses of a variety of programs and data. These studies looked at aspects of educational, behavioral, health, relational, and criminal outcomes. The literature review section is organized study-by-study and is followed by a synthesis section.

Literature Review

Anders et al., 2023. In “The Effect of Early Childhood Education on Adult Criminality: Evidence from the 1960s through 1990s,” Anders et al. discuss how improvements to early childhood education resulted in a 20% reduction in later adult crime. The researchers found substantial benefits from the preschool program by targeting low-income and low-resource areas. These researchers claim that reducing the number of criminals is important because many crimes are committed by repeat offenders. They claim that under 6% of the population commits most of the crimes and preventing one person from developing into a career criminal can have an outcome of 100 fewer victims in a single year. Anders et al. look at the impacts of early childhood education on later criminality as many studies on this are imprecise and outdated. They use administrative crime data in North Carolina to look at two large early childhood intervention programs. This gives the researchers access to hundreds of thousands of data points.

They also emphasize looking at modern early childhood programs and the impacts these have on adulthood. Anders et al. look at the Head Start program, a federally funded childcare program for disadvantaged families and Smart Start, a program that funds several types of early childhood programs in the community. They found that in high-poverty areas, both programs were responsible for reducing crime by about 20%. Specifically, the researchers claim that Head Start availability reduces crime in a high-poverty community by 1.3 percentage points up to the age of 35. Smart Start reduces the probability of criminal activity by .6 percentage points up to age 24 in all areas according to the source. They also found that Smart Start's impact on the reduction of crime is most prominent in high-poverty communities and has a 1.2 percentage point reduction in crime. Anders et al. also found that the program has the strongest impact on black students (Anders et al., 2023).

Manning and Patterson, 2006. According to Manning and Patterson, the Perry Preschool Project (PPP) started in 1962 with a population of 123 three-year-old, disadvantaged, African American children in Ypsilanti, Michigan. They claim that the participants were randomly assigned to either a control group or a treatment group. The treatment group was assigned to attend the preschool program while the control group did not have any treatment. The study follows the participants up to the age of 40 years old. Manning and Patterson evaluate different aspects of education, career, criminal behaviors, social relationships, and health. The researchers find the largest impact is on females. They also found that the treatment group had higher rates of graduating high school than the control group. In addition, Manning and Patterson found that the treated group had fewer mental impairments and fewer individuals who repeated grades in school. Furthermore, the researchers said that the treated group scored higher on general exams and literacy exams. They also said that in the treated group, parents had a more

positive attitude toward schooling. The authors found that the treatment group, as adults, had higher levels of employment, bigger incomes, and lower arrest rates. They also found that the treated group had more stable home lives and fewer incidents illegal of drug usage. The cost-analysis report from this study shows the extra tax dollars were well worth the investment due to the future economic stability and reduction of crime (Manning & Patterson, 2006).

Parks, 2000. According to Parks in the “High/Scope Perry Preschool Project,” the High/Scope Perry Preschool Project (PPP) was developed to facilitate the development of children socially and intellectually. This study by Parks is more focused on the behavior and crime reduction implications of the PPP than the study by Manning and Patterson. The research was conducted as a randomized controlled study. According to Parks, for over 2 years, the participants who were receiving treatment attended the preschool program for 2.5 hours each weekday. He claims that the staff-to-child ratio is 1:5/6. Furthermore, the children received home visits from their teachers once a week for 1.5 hours. The staff facilitated monthly meetings for the parents to mingle and receive training. When looking at later outcomes, Parks says that delinquency rates were significantly lower for children who received the treatment. Within the ages of 15 to 19, the treatment group had lower rates of misconduct such as fighting or other violent behaviors. Parks claims that there were lower rates of vandalism and police interactions for the treatment group. Parks also says that the treatment group spent fewer months in jail overall than the control group. According to Parks, up to the age of 27, the group which received treatment had significantly fewer incidents of arrest than the control group. The participants who received treatment had half as many arrests as those who did not receive treatment. In the control group, 36% had 98 felony arrests from ages 19-27, and 27% of the treatment group had 40 felony arrests from ages 19-27. Parks claims that in the control group, 35% were common

offenders while only 7% of those who attended the pre-K were labeled as frequent offenders. In the control group, 25% were arrested for illegal drug usage, versus 7% of the treatment group. Parks also says that in comparison to the control group, the treatment group had half as many people who were on probation for over 18 months. Parks says that the PPP returned more than 7 times the initial investment for each child and yields \$7.16 for each dollar spent. Parks says that the investment in the project returned \$88,433 per child. He says that these savings come from participants growing up into productive citizens. Parks says that in the treatment group, 72% of children versus 57% in the control group scored highly on measures of cognitive and noncognitive scales (Parks, 2000).

Preskitt et al., 2020. Preskitt et al. in “The Persistence of Reading and Math Proficiency: The Benefits of Alabama’s Pre-Kindergarten Program Endure in Elementary and Middle School” strived to understand Alabama’s First Pre-K (FCPK) and the impact it had on math and reading skills. They used a multivariable linear regression in a non-experimental analysis. The researchers observed the students in the early pre-Kindergarten program. They mentioned that this can bring about limitations as families choosing to participate could be different from families who do not choose to participate. The researchers state that the control group is children who did not participate in the state pre-Kindergarten but remained observable by entering grade school in Alabama public schools. The treatment group is children who were assigned to the pre-Kindergarten program and remained observable by entering the Alabama public elementary schools. They looked at data for the cohorts entering kindergarten between 2009-2014 (Preskitt et al., 2020).

The Alabama Department of Early Childhood Education is an agency responsible for assuring that early childhood education programs receive support. Therefore, the goal of the

FCPK is to enable assessable, high-quality early childhood education. FCPK is in each of the 67 Alabama counties. They offer pre-K programs through the public school system, Head Start, and private childcare centers in several locations such as churches, universities, and military bases. In the 2005-2006 school year, Alabama's program served 1.7% of 4-year-old children. By the 2018-2019 school year, the program was serving 32% of 4-year-old children. Preskitt et al. claim that lead teachers and teacher aids must meet many qualifications such as certifications and degrees. They say that the teachers receive pay similar to K-12 public teachers. All the classrooms have a specific curriculum to follow, and the teachers receive onsite professional development. Preskitt et al. say that adult-child interactions and child-centered approaches are central to the program's approach (Preskitt et al., 2020).

Preskitt et al., acknowledge many studies on early childhood education that start with high impact but fade to about half of the initial impact. They claim that this fade depends on the pre-K quality as well as the quality of further learning environments. The sustaining environments hypothesis might be one potential cause of this. They also referenced research saying that math fade-out was eliminated when children attended a pre-K program and then went into kindergarten and 1st grade classrooms in which teachers had professional support (Preskitt et al., 2020).

Preskitt et al. state that a limitation of this study is that they had no way of knowing if the control group was enrolled in another form of pre-K. Furthermore, standardized testing does not happen until the 3rd grade, so the results of the study were limited to after the 3rd grade. The results indicated that, after controlling for influencing factors, the participants who received treatment had higher scores in reading and math compared to those who did not receive treatment. Looking at five cohorts of students in three school years, the researchers found that

35.4% of students in the treatment group were proficient in reading. Preskitt et al. found that 47% of the treatment group were proficient in math based on test scores. There is no evidence suggesting that the statistical significance of FCPK was lost over time (Preskitt et al., 2020).

Ruhm and Waldfogel, 2020. Ruhm and Waldfogel, in “Long-term Effects of Early Childhood Care and Education In Ministerråd” analyze secondary data and survey literature from multiple countries to assess the significance of early childhood education on a universal level. The researchers discuss how important the quality of a program is in determining the effects of early childhood education. They found that the results of early childhood education depend on how the preschool is in relationship to the next best alternative for childcare. Ruhm and Waldfogel say a limitation of this study is that the effects of childcare will be different on the children who are being moved from a lower quality childcare than from children who are being moved from a higher quality childcare into the program. They also say that another limitation is that research on the long-term impact of early childhood education is scarce because many programs have not been around that long, and many other elements of life have not been investigated in the long-term studies that are out there. The authors control for parental education and income level in the study (Ruhm & Waldfogel, 2020).

In Norway, the authors found that preschool increased educational attainment, labor force participation, and decreased welfare support. The programs tended to have the largest impact on the children of low-income mothers. The program did not increase mothers’ labor supply but led to more families using formal care rather than informal care. After examining several countries, the authors found that the impacts of early childhood education were consistent. They found that the expansion of preschool programs had overall positive results. In virtually all studies, Ruhm & Waldfogel found that these programs yield economically beneficial results from childhood to

adulthood. The impacts were the largest for disadvantaged students and were sometimes restricted to these groups (Ruhm & Waldfogel, 2020).

Ruhm & Waldfogel state the benefits of these early childhood education programs are most prominent for economically disadvantaged students. The authors suggest expanding programs targeting disadvantaged students might be more important than the universal expansion of early childhood education. However, Ruhm & Waldfogel say that this is countered by two points. The first point they make is that universal programs may raise political support to keep the programs well-funded and widely produced. Additionally, they point out that keeping the programs universal might help to maintain their quality which can be important to the results (Ruhm & Waldfogel, 2020).

Hajizadeh et al., 2017. According to Hajizadeh et al. in “Potential Return on Investment of a Family-centered Early Childhood Intervention: A Cost-effectiveness Analysis” implementing a program called ParentCorps has shown highly effective results. They seek to understand the implications of a pre-Kindergarten program, ParentCorps, in low-income schools compared to other pre-Kindergartens. The model was performed in 2015 and 2016. They used two randomized control trials in 18 low-income schools in NYC. They randomly assigned each school to a treatment group (which received treatment) and a control group (which received no treatment) (Hajizadeh et al., 2017).

Hajizadeh et al. say this program is pre-K targeting disadvantaged and minority youth. It is a family-centered program. The program aims to engage the whole family to cultivate safe and effective home environments. The program primarily serves Black and Latino students. With two randomized controlled trials, the researchers tracked 1,200 children. These programs are found to have sustained results through the age of 8 in physical health, academics, and behavior. The

researchers point out that these factors predict future costly medical conditions and disabilities (Hajizadeh et al., 2017).

Hajizadeh et al. tracked the children through the 2nd grade and found lower rates of obesity and fewer behavioral problems. The researchers built a simulation the children in both the treatment group and the control group would be entered at age 5. The program follows the children through age 8 and then transitions the children through a variety of different potential life scenarios to death. They base these transitions on the child's behavior and academic achievement through age 8 and on the predicted consequences of their previous behavior. A limitation of this study is that several assumptions were necessary to create the model. To combat this, the researchers overestimated the costs of the program and underestimated the benefits. However, sensitivity analysis still found the model to be robust (Hajizadeh et al., 2017).

Hajizadeh et al. estimated the program saves \$4,387 for each enrolled individual and increases each participant's life expectancy by .27 years. This was measured based on predicted drug abuse, obesity, diabetes, health, graduation from high school, criminal behavior, and employment. The program budgeted \$888 per child and returned \$5,275 per child. They found that the ParentCorps programs were cost-effective in all scenarios except if the pre-K is serving less than 10 students because costs were too high at this point to offset the benefits. The researchers found that even if the results of the intervention would only last 1 year, which is unlikely, it would still save money. The most at-risk children showed the biggest results from the program (Hajizadeh et al., 2017).

Garcia et al., 2019. In "Early Childhood Education and Crime," Garcia et al. investigate the impacts of quality early childhood programs on later criminal behaviors. The researchers investigated a program called Carolina Abecedarian Project (ABC) and the Carolina Approach to

Responsive Education (CARE). These two programs both took place at the University of North Carolina at Chapel Hill. The childcare programs cater to children ages 8 weeks to 5 years old. They targeted highly disadvantaged children born between 1972-1980 in Chapel Hill, NC. In the program, the average age of mothers was 20, 74% of the fathers were not present, the child was typically the mother's first child and 94% were African American. In ABC there were 114 families, 58 of which received treatment. The other 56 families were in the control group. The treatment group consisted of families who were in the preschool program. In the CARE program, there were 65 families with 23 in the randomized control group, 25 in the treatment group focused on family education, and 17 in the childcare program. For both ABC and CARE, the control group did not receive any sort of treatment (Garcia, et al., 2019).

The goal of the ABC/CARE program was to foster cognitive and language skills. The program promoted teacher and student interactions. The centers had small student-staff ratios (1:4 to 1:6) and focused on individualized learning and learning in small groups. Additionally, they offered nutritious meals and routine medical checkups. The teachers and aides had continuous training to ensure that each child had quality and consistent programming (Garcia, et al., 2019).

According to Garcia et al., this was a randomized controlled trial. Data was collected through self-reports and administrative records. The follow-up collections of data occurred at ages 12, 15, 21, 30, and 34. When participants were adults they measured for education, employment, family status, health, and criminal activity. The researchers conclude that females benefit more than males from the treatment. However, the savings to society from males is greater than it is for females because men commit more costly crimes. The crime-saving cost for males in the program is \$466,318 and \$32,790 for women (Garcia et al., 2019).

The researchers claim that early childhood education builds the foundation for greater self-control and has been linked to the reduction of crime. The researchers find that these programs have the greatest impact on disadvantaged children. The researchers acknowledged that programs with the greatest impact on reducing crime focused on child-led learning environments (Garcia, et al., 2019).

Petitelerc and Brooks-Gunn, 2022. Petitelerc and Brooks-Gunn seek to understand if home-based intervention or a childcare center intervention is more influential in future crime reduction. The researchers designed programs to support children born prematurely or with low birth rates. They chose these populations as they are at a higher risk of low cognition, low academic achievement, and committing crimes. The Infant Health and Development Program randomly assigned 1090 babies who fit this category to a treatment group (received treatment) or a control group (did not receive any sort of intervention). The sample population was primarily African American, urban, and of low socioeconomic status. The participants came from 8 participating hospitals throughout America and would be of 40 weeks of gestational age at some point in January to October 1985. There were half as many infants placed in the treatment group as in the control group (Petitelerc and Brooks-Gunn, 2022).

According to Petitelerc and Brooks-Gunn, the treatment group was provided with both home visits from ages birth through 3 and childcare in a pre-K from 1 to 3. The home visits were offered once a week from 40 weeks gestational to the first year of life. After the first year, home visits were offered every two weeks for the next two years. During home visits, parents were given information from trained employees about the child's health, the child's development, and best parenting practices. They were also offered full-day daycare in high-quality developmental centers starting at 12 months and going to 3 years. Transportation was provided. The extent to

which families participated varied. They used this variation to look at attendance rates and later impacts on criminal behavior. The researchers acknowledged that this created a selection bias as families' level of participation can be linked to other factors also associated with the outcomes (Petitclerc and Brooks-Gunn, 2022).

Petitclerc and Brooks-Gunn found no statistically significant difference in reducing crime at age 18 between the treatment and control groups until they separated for sex. After doing this, they found the odds of boys in the treatment group being arrested were reduced by 57%. They found no effect on girls. They found that each additional 4 home visits and each additional 20 days in the center, reduced the likelihood of boys being arrested by 4%. Overall, they found that each additional 20 days in the center reduced the child's effect of being stopped by the police by 3%. They also mentioned that early childhood education can have a long-term impact on justice reduction even when the behavioral impacts fade. The study finds that both home visits and quality early childhood care programs are important to reducing crime, with center-based care being the most prominent (Petitclerc and Brooks-Gunn, 2022).

Reynolds et al., 2010. Reynolds et al. in "The Chicago Child-Parent Centers: A Longitudinal Study of Extended Early Childhood Intervention" investigates the impacts of the Child-Parent Center on cognitive and noncognitive abilities. They conducted a quasi-experimental study that took place in Chicago and over 1,500 children participated. Reynolds et al. say that participants were born between 1979-1980 in high-poverty neighborhoods. There were 989 children in the program while 550 participated in a full-day public program. This is typical for the community. The researchers collected data yearly on the cognitive and noncognitive skills of the participants up to the age of 15 (Reynolds et al., 2010).

Reynolds et al. say that the CPC program provides educational instruction and family support services starting at ages 3 to 4. Basic math and language art skills are emphasized through structures and a variety of different learning options such as large-group, small-group, individual learning opportunities, and field trips. These classes highlight literary analysis with oral, listening, and speaking skills. The preschool is a half-day program. Reynolds et al. claim all teachers are required to possess certifications in early childhood education and bachelor's degrees. The staff-to-child ratio in the program is 2:17. The program is run by a head teacher and a parent resource teacher who creates activities to involve the parents. They found high participation in the treatment group ensuring representative results (Reynolds et al., 2010).

Reynolds et al. look at incarceration status from ages 18 to 24. Criminal activity was measured through any history of jail time. The researchers found that juvenile arrest status and adult incarceration was lowered by preschool attendance. They found the overall marginal effect of preschool attendance on delinquency to be -7.0 percentage points (Reynolds et al., 2010).

Reynolds et al. test children academically upon entry and exit at kindergarten and then again at ages 12 and 14. The treatment group has lower rates of grade retention and special educational needs. The treatment group scored higher on most noncognitive skills and readiness to enter the classroom. The treatment group demonstrated less trouble making displays of behavior. They found all results of the treatment to be significant at the 5% level after controlling for socio-demographic factors. Looking at test scores such as reading, math, and retention rates of children ages 5 through 14, they found that children in the treatment group averaged scores that were 3-5 points higher than the control group; this difference is equal to what a child would learn in 5-6 months of kindergarten. They find that classroom adjustment, social skills, school

commitment, and parental involvement were much higher for children in the treatment group (Reynolds et al., 2010).

Reynolds et al. found that participation in the program results in increased cognitive and noncognitive skills. The noncognitive skills are important for educational achievement but also explanatory for why incarceration rates decrease with early childhood education. Reynolds et al. found that participation in a quality pre-K program can reduce criminal behavior through educational achievement and the development of noncognitive, crime-reducing skills (Reynolds et al., 2010).

Olds, 2016. Olds in “The Nurse-Family Partnership” studies the impacts of nurse visits on the family’s economic development and the child’s health and development. Today, the program serves over 20,000 families. According to Olds, the program focuses on high-poverty and first-time mothers in Elmira and Memphis. He claims that the nurses work to secure high-quality preschools for the families they serve. Olds says that the model focuses on family support and education from nurses. Olds says that the nurses have detailed plans for their visits but that the nurses can adapt these plans to fit the family’s interests and needs. He also says that the nurses work with parents to develop a futuristic outlook encouraging schooling, finding work, and planning future pregnancies. Olds says that they use strategies to cater to parents’ instincts to protect their children. Olds found significant results in improving prenatal health and lowering prenatal tobacco use (Olds, 2016).

Olds found in the Elmira trial that the program reduced childhood injuries and resulted in a 56% decrease in emergency room visits up to the child’s second birthday. In the Memphis trial, he found a 79% reduction in the number of days the child spent in the hospital before their second birthday. This is very relevant as the leading cause of death in young children is injuries

and the impact of decreasing these injuries was most evident in mothers living in socially disadvantaged areas. It also increased the time between having the first child and a second child with 12.5 months greater intervals between births. It had significant impacts on partner relationship sustainability, reducing the use of welfare, increasing maternal employment, and improving cognitive skills. Olds claims that it produced a long-term 48% reduction in abuse and neglect cases among the participants. He also points out that it reduced the chances of mothers being arrested and of children being arrested up to the 15th birthday of the first child by 60%-70%. Specifically, he says that it reduced the children's arrests rates by 40% and conviction rates by 60% until the age of 19. In the Memphis trial, it was 4.5 times more likely that a child in the control group would die than a child in the treatment group. Olds finds that there is about a \$17,000 return on investments for each family served. This results in \$2.80 and \$5.70 per dollar initially invested. Olds found the greatest returns to be on the families with the greatest need (Olds, 2016).

Durkin et al., 2022. Durkin et al. present the findings of a longitudinal randomized control study on the extent to which a pre-Kindergarten that is state-supported impacts children's behavior, attendance, and achievement scores through the sixth grade. The authors report on results from the class cohorts of 2009 and 2010 statewide in Tennessee. Students were assigned randomly to a treatment (attending pre-K) or a control group (not being selected to attend the pre-K). The program, TN-VPK, began in 1996 and was implemented statewide by 2005. More than 18,000 children who were 4 years old and from low-income families attend the TN-VPK program. They are required to offer 5.5 hours of educational time per day, 5 days a week. Class sizes are limited to 20 students and each classroom is staffed with a state-licensed teacher and a teacher aide. The curriculum is selected from a list that has met state approval. The program pays

its pre-K teachers at the same rate as elementary teachers and offers teachers retirement benefits, healthcare, and paid time off to ensure teacher quality. Durkin et al. say that all the program's teachers have bachelor's degrees and certifications for early childhood education. Overall, the program was very high quality (Durkin et al., 2022).

The study Durkin et al. performed was found to have negative results. They mentioned there might have been selection bias in this study as few parents would allow a flip of a coin to determine whether their children went to preschool. They found that children in the program scored lower on state exams in 3rd-6th grade than the control group. The negative impacts of the program peaked in 6th grade. Additionally, Durkin et al. found that the students who attended the program had higher rates of disciplinary incidents, more special education services, and lower attendance rates than the students who did not attend the program. They found initial positive strong results at the end of pre-K, but by the end of kindergarten, the results were not statistically significant. Among the small portion (12%) of students who later went to high-quality schools and had high-quality teachers, the pre-K program positively impacted the state achievement test scores of the treatment group. The researchers extended the study to look at results through 6th grade. With 79 program sites and 2 cohorts of pre-K classes to focus on, Durkin et al. found that the control group outperformed the treatment group on state achievement tests in the 6th grade (Durkin et al., 2022).

Durkin et al. suggested that one reason for the fadeout could be that in the pre-K program, there is a large focus on concrete literacy skills and less emphasis on language and math skills. Early literacy tends to be finite so this may show why children are initially ahead but there are no effects by the end of kindergarten. Teaching them how to think and explore could perhaps be more beneficial. These skills become increasingly important over time but are not

usually the ones stressed under school readiness preparation according to the researchers (Durkin et al., 2022).

Wan et al., 2021. Wan et al. in “Is Intervention Fadeout a Scaling Artefact?” investigate if fadeout truly persists after early childhood education or if it is just perceived based on the testing scale. The researchers suggest that the fadeout could be because cognitive skills are tested on a numerical scale creating the illusion of fadeout. To evaluate this question, Wan et al. look at a randomized control trial that was performed on math interventions. This program is referred to as TRIAD. The original analysis of this study shows that the results had faded out by the time participants exited 1st grade. Wan et al. say that the TRIAD experiment included 42 high-poverty schools located in Buffalo, NY and Boston, MA. The original report, published in 2013, showed substantial fadeout through the end of 1st grade. Wan et al claim in the control group there were 391 students and 16 schools. They claim that in the treatment preschool group, there were 494 students and 14 schools. They say that in the treatment preschool with home visits, there were 420 students and 12 schools. For both preschools, the teachers received pedagogical development and mathematics curriculum training. Wan et al. say that in the follow-through program, the teachers received additional professional development in teaching math. The control school kept its current math programs. Wan et al. claim that the program was designed to teach students at their level as they grew throughout the program. Wan et al. state that the instructional time was designed to take 15-30 minutes per child. The study found that the fadeout seemed to be minimal and that the effects seemed to last at least two years after the student completed the program (Wan et al., 2021).

Synthesis

It appears that the overall quality of early childhood education regarding the next best alternative of care is extremely important in whether the program has a long-term positive or negative impact on the children. Most of the sources seemed to agree that the programs which specifically targeted low-income areas seemed to have the most substantial results. The successful programs were engaging to the parents, had developmentally appropriate activities for the children, had smaller class sizes, and focused on adult-child interactions. It also seems programs that engaged the parents and offered childcare had the most effective results. These methods helped to ensure quality childcare in and out of the home. Engaging the parents also had other benefits such as pregnancy planning and creating good parenting practices. This gives parents the resources to sustain quality interactions with their children throughout their lifetime.

Early childhood education, when using high-quality practices, yields positive economic results specifically regarding disadvantaged children. However, when it is a low-quality program compared to the next best alternative of care, the children tend to be better off with the higher-quality care options. While academics sometimes faded out, this would not necessarily measure the true effect of early childhood care.

There is still more research needed to show the most effective ways for childhood care to lead to later economic savings. There is more research needed on how much should be invested and if there is a limit on the amount to where it is no longer impactful. Additionally, more research is needed on how the programs impact people who are connected to the child participating. The programs that focus on working with families could be impacting mothers' decisions to have children and how they parent their children. Therefore, this could be yielding

an economic benefit in ways that are hard to evaluate. Further research into these questions would help inform policy about the funding and operation of early childhood care.

Methodology

My independent variable x_s is the percentage of children ages 3-4 from families under the 200% poverty levels who attend preschool between 2005-2009 by state s . My dependent variable y_s is youth who are residing in juvenile detention, correctional, and/or residential facilities for state s , between 2015-2019. This variable is scaled out of 100,000 youth. The variable z_s is a control vector for this study. The variable z_{s1} is the percent of families below the poverty level. The variable z_{s2} is the percent of teenagers (16-19) who are in school or have a diploma or GED. The variable z_{s3} is equal to teen birth rates. The variable z_{s4} is representative of families who have been subjected to an investigation by child protective services. The variable z_{s5} is the percent of parental unemployment rates. E_s is the error.

Abstract Equation #1:

$$y_s = \alpha + x_s\beta + z_{s1}\gamma + z_{s2}\gamma + z_{s3}\gamma + z_{s4}\gamma + z_{s5}\gamma + E_s$$

$$H_0: \beta = \emptyset$$

$$H_1: \beta \neq \emptyset$$

Data

To analyze the impact of early childhood education on future crime rates, I analyzed data through regression analysis using the software platform R Studio. I included several controls which other literature on incarceration rates found to be relevant. Specifically, in my literature review, I found that early childhood education was most impactful on children from low socioeconomic families. Keeping this in mind, I analyzed data on the percentage of children

enrolled in an early childhood education program between the ages of 3-4 by state for families under the 200% poverty line.

Preschool Attendance (x_s). The data for my independent variable, kids who attended pre-Kindergarten, is from Kids Count. This data originally accounts for children between the ages of 3-4 who did not attend preschool based on poverty rates. From this, I pulled the data for the children who were not in school for families under the 200% poverty line. I used the data that was in percentage by state averaged across 2005-2009. I then subtracted this percentage by 1 to find the percentage of children ages 3-4 under the 200% poverty line who were in school. The data for Wyoming was missing so I omitted this state from my analysis. The data for this variable will be referred to as ‘Preschool Attendance.’

Juvenile Justice System (y_s). The data for my dependent variable came from Kids Count and included data on youth residing in juvenile detention, correctional, and/or residential facilities. This data is scaled to be out of 100,000. I pulled the data for this from 2015, 2017, and 2019. I summed all three years by state and divided them by 3 to match the structure of the independent variable. These years were chosen because they were within 10 years of the preschool data. This means the children who were 3-4 in the childcare data would be between 6 to 18 in the juvenile justice data. This provides a wide sample of children able to be involved with the juvenile justice system. This data included the population of children from 10-21 years of age. This variable will be referred to as ‘Juvenile Justice System.’

Poverty Level (z_{s1}). I used the poverty level as a control for juvenile justice involvement. The dataset is for families in poverty from the US bureau census SAIPE and contained across 2015-2019 by state. The data for this variable will be referred to as ‘Poverty Level.’

Teenager Schooling (z_{s2}). The data for teens who attend school is from Kids Count and shows the percentage of children 16-19 who are not in school or have not graduated with a high school diploma or GED equivalency. I used the data range of 2015-2019 and added this range together and then divided it by the number of years (5) to find the average. I then subtracted this number from 1 and multiplied it by 100 to scale it. The one exception to this data is Vermont, which is missing data from 2018, so I divided this number by 4 rather than 5. The data for this variable will be referred to as ‘Teenager Schooling.’

Teen Birth Rates (z_{s3}). The data for teen births came from Kids Count. I found the percentage of teen births by adding up the percentages by state for the years 2015-2019 and then dividing it by the number of years (5) to find the average for this time frame. This number was scaled at a rate per 1,000 teenagers. The data for this variable will be referred to as ‘Teen Birth Rates.’

CPS Investigation (z_{s4}). The data for child protective service (CPS) is from Kids Count and includes any child who CPS investigates whether it was sustained. This data is from the years 2015-2019 to control for its impact on juvenile delinquency rates. It is the number out of every 1,000 minors and the average is found over the 5 years by summing each year together by state and then dividing by the number of years (5). The data for this variable will be referred to as ‘CPS Investigation.’

Parental Unemployment (z_{s5}). The data for unemployment rates comes from Kids Count and was narrowed down to the years 2015-2019 to control for parental unemployment on juvenile delinquency rates. These years were combined and divided by the number of years (5) to find the average. The unemployment rate was found by Kids Count by taking the number of unemployed parents divided by the total number of parents who are in the labor force. The

parents who are not working or seeking employment are not included in this calculation. The data for this variable will be referred to as 'Parental Unemployment.'

Results

Table 1 represents the descriptive statistics for each variable. The table shows the mean and standard deviation of each variable. On average, there were 132 youth in juvenile detention, correctional facilities, or residential facilities per 100,000 individuals aged 10-21. On average, 37.469% of children ages 3-4 from families under the 200% poverty line attended preschool. On average, 13.162% of the population was living in poverty. On average, 96 of 10,000 teenagers between 16-19 were not attending high school or had not received a high school diploma or GED. For every 1,000 teenagers, on average, 19 had given birth. For every 1,000 minors, on average, 48 were investigated by Child Protective Services. On average, for families with children, 3.445% of parents in the labor force were unemployed. To summarize, this table shows the average of several different variables that I use to control my regression analysis. It shows the implication of these variables on society and gives an idea of how it could be impacting my results.

Table 2 repeats regression results from equation 1. The number of children in school between the ages of 3-4 negatively correlates with the number of children in juvenile facilities. I chose my control variables based on what sources in my literature review deemed important in studying incarceration rates. The control of poverty is highly susceptible to the other variables involved. I suspect this is because of how much overlap there is between the other variables and poverty. Specifically, the variables that significantly impacted poverty's coefficient were unemployment rates, CPS reports, and teen births. Because of these overlaps, I have three specificities showing the results with different sets of controls. Throughout all three specificities

in the table, the data shows that states with higher enrollments in pre-Kindergarten for families under the 200% poverty line have lower rates of youth involvement with the juvenile justice system 6-14 years in the future. This variable remained statistically significant with a p-value of under 5% in all specificities.

In Table 2, with all the controls included, the p-value was 0.00106. The data showed the equation to be juvenile justice system = 227.269 - 3.0007(Preschool Attendance) - .5226(Teenager Schooling) + 18.738(Parental Unemployment) + .07831(CPS Investigation) - 7.7732 (Poverty Level) + 3.501(Teen Birth Rates). The unemployment rate of parents between 2015-2019 had a very significant rate on the dependent variable. In Table 2, with poverty as the only control, the impact of poverty can be seen. The equation for this is juvenile justice system = 195.950 - 3.434(Preschool Attendance) + 4.944(Poverty Level). The p-value in this setting is .003179. Specification 1 in Table 2 shows the data with no controls. The equation for this is juvenile justice system = 259.867 - 3.403(Preschool Attendance). The p-value for this specification is .00383.

Economic Magnitude. Results suggest there is a 23%-26% decrease in juvenile activities 6-14 years in the future for children aged 10-21 for a 10-percentage point increase in early childhood education. This results in significant savings to society through the reduction of imprisonment levels.

As Table 2 shows, the results for the impact of early childhood education on later juvenile delinquency rates are statistically significant at the 5% level. This shows the relevance of preschool attendance for 3–4-year-old children from low-income families. As the literature review suggests, preschool can be very important for future incarceration rates when it is of high-quality and better than the next best alternative of care.

Limitations

One limitation of my study is that it is not an experiment, so I am not able to completely get rid of omitted variable bias. However, in my calculations, I used control variables to help limit this bias. These results cannot be interpreted as causal as I am not conducting an experiment or quasi-experiment on early childhood education. Rather than following specific children throughout their life, I am looking at the general preschool attendance levels and future juvenile delinquency rates by state.

Conclusion

Due to the economic investment that prisons require and the recent exposure to the inhumane treatment prisoners face, this study addresses an important question: could financial investment upfront in early childhood education result in long-term economic savings through a reduction in criminal activity? The data analysis shows that by targeting low-income families with the implementation of early childhood education programs, we may be able to significantly reduce later criminal activity.

Based on the literature, I focused on early childhood education for lower-income families. The literature showed that high-poverty areas saw the most positive impacts on economic savings from the implementation of early childhood education. My data showed significant decreases in later juvenile justice system interactions in states where early childhood education attendance is higher among high-poverty families. This relates to many of the studies in the literature, such as the Perry Preschool Project, which shows that targeting low-income areas has a significant reduction in later criminality.

The data I used showed a 23% to 26% reduction in juvenile criminality for a 10-percentage point increase in attendance of early childhood education. The percentage is found by

multiplying the coefficient for preschool attendance by ten and then dividing by the average of later juvenile justices' involvement of children aged 10-21 by state (132.34). In a similar conclusion by Anders, et al., there was a 23% to 28% decrease in later criminality when there were high-quality preschool programs available in the community. In this study, the researchers looked at the availability of high-quality, accessible preschool programs in the area. This was different than in the data I analyzed as I looked directly at the preschool attendance levels and the juvenile delinquency levels by state. Despite these differences, the decrease in incarceration that I found is similar to what Anders, et al. report being the impact of the availability of high-quality preschools in high-poverty areas.

Future Research

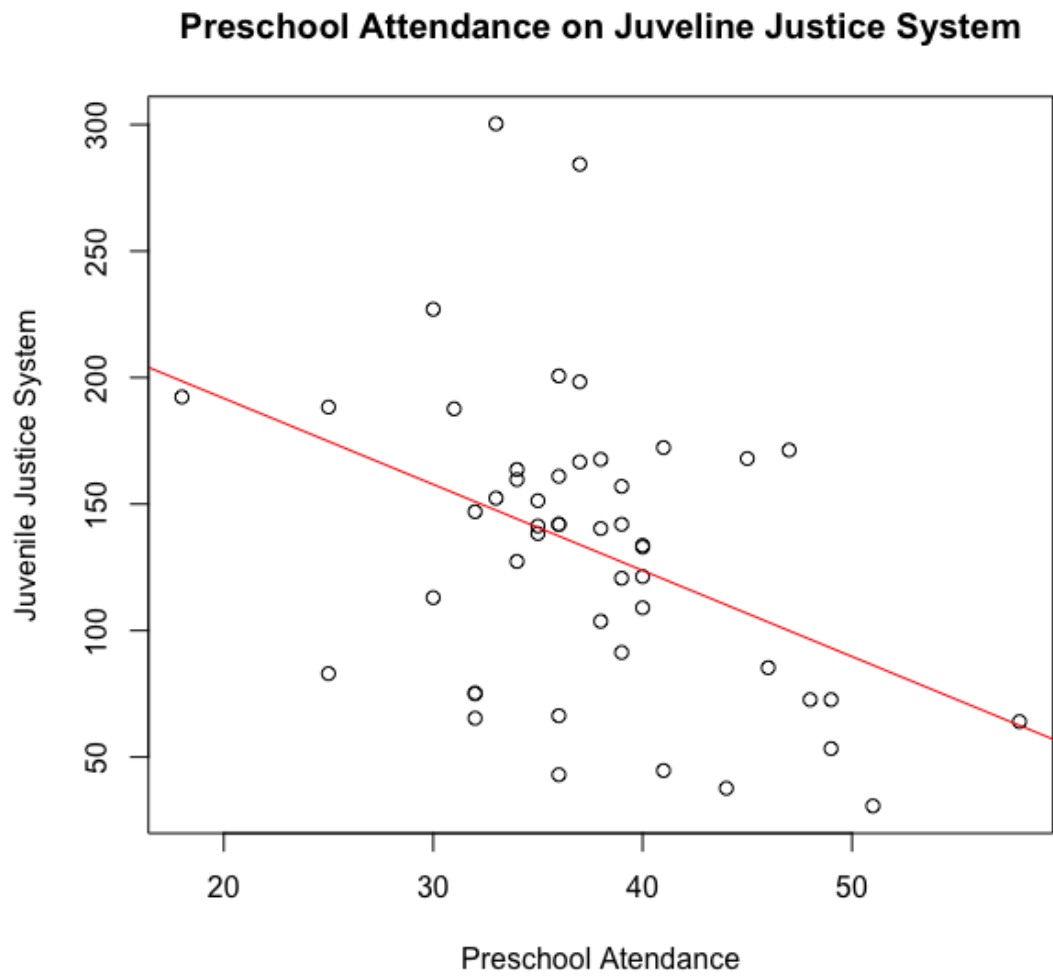
I recommend future research that includes an experiment that looks directly at the difference in the results of high-quality preschool programs between low-income and high-income areas. I suggest doing this by conducting an experiment with a treatment group of low-income students who attend high-quality preschool and a control group of low-income students who applied to the preschool but were assigned to not attend preschool. I recommend the researchers should mimic this study with non-low-income students. I suggest following the students throughout their lifetime by evaluating administrative data and self-reported evaluations. I believe that this sort of research study would give further insight into the efficacy of early education programs under various circumstances and help the scientific community better understand the disparities in results between research studies discussed in the literature review such as the non-successful TN-VPK and the successful Perry Preschool Project, which targeted specifically low-income areas.

Tables and Figures

Table 1: Summary Statistics

	Time Frame	Mean	St. dev
Juvenile Justice System (Y)	2015-2019	132.347	59.029
Preschool Attendance (X)	2005-2009	37.469	7.036
Poverty Levels	2015-2019	13.162	2.843
Teen Birth Rates	2015-2019	19.347	6.506
Teenager Schooling	2015-2019	95.970	1.005
CPS Involvement	2015-2019	48.392	21.622
Parental Unemployment	2015-2019	3.445	.847

Notes: Each variable has 49 observations of data for states. These statistics show the means and standard deviation for each variable and control. Data comes from Kids Count and SAIPE US Census.

Figure 1:

This chart is a scatter plot on preschool attendance among low-income families from 2005-2009 and later rates of youth criminality by state from 2015-2019. The data comes from Kids Count.

Table 2: Regression Results

	1	2	3
Preschool Attendance	-3.403 (.004)***	-3.343 (0.003)***	-3.007 (.011)**
Poverty Level		4.944 (0.074)*	-7.773 -0.142
Teenager Schooling			-0.523 -0.961
Parental Unemployment			18.738 (.089)*
CPS Investigation			0.783 (.041)**
Teen Birth Rates			3.503 (.095)*
Observations	49	49	49
R ²	0.165	0.221	0.399
St. error	54.53 w/ 47 DF	53.21 w/ a 46 DF	48.94 w/ 42 DF
F Value	9.258 on 1 and 47 DF	6.534 on 2 and 46 DF	4.638 on 6 and 42 DF
P Value	0.004	0.003	0.001

Notes: DF= Degrees of Freedom. The first row of each variable represents the coefficient, and the second row represents the individual p-value, ***= statistically significant at the 1% level ** at the 5% level, * at the 10% level. This table demonstrates the statistical significance of preschool attendance from low-income families on later criminality rates. This X variable is statistically significant at the 5% level with all controls present. Data comes from Kids Count and SAIFE US Census.

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